MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

BQT1614 – QUANTITATIVE ANALYSIS

(All Sections/ Groups)

15 MARCH 2019
9 a.m. – 12 p.m.
(3 hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of TEN (10) pages (including the cover page).

2. Answer **ALL** questions. The distributions of marks are given in parentheses.

3. The Formulae Sheet and the Statistical Tables are provided.

3. Please write all your answers in the Answer Booklet provided.

QUESTION 1 [20 marks]

(a) A study is made by the recording industry in the United States of the number of music CDs owned by 14 senior citizens.

25	35	41	48	52	81	98
118	132	133	154	158	162	174

i) Compute the mean and variance for the number of CDs owned by the senior citizens. [3 marks]

ii) Compute the median for the number of CDs owned by the senior citizens. [3 marks]

iii) Determine the shape of the distribution and interpret your value. [3 marks]

iv) Determine the sample size required to ensure the estimation of 99% confidence allowing margin of error to be 5. Given that the population standard deviation is 51. [3 marks]

(b) There are five people being considered for the position of CEO at a company. Three of the applicants are holding MBA degree. Two are male, of which only one has MBA degree.

i) What is the probability that a candidate is male and holds MBA degree. [2 marks]

ii) What is the probability for a female candidate to hold an MBA degree. [3 marks]

iii) What is the probability that a candidate is female or has MBA degree. [3 marks]

QUESTION 2 [20 marks]

(a) An internal study by the human capital department revealed that company employees receive an average of two non-work-related emails per hour.

i) Compute the probability that the CEO received at least two non-work-related emails during lunch hour 1pm – 2pm yesterday. [3 marks]

ii) Compute the probability that the secretary of CEO to receive one or two non-work-related emails during the first 10 minutes she start working in the morning. [4 marks]

Continued...

(b) The annual commissions earned by sales representatives of Machine Products Sdn. Bhd. is normally distributed with a mean of RM40,000 and the standard deviation of RM5,000.

i) What percentage of the sales representatives earn more than RM42,000 per year?

[4 marks]

ii) What percentage of the sales representatives earn between RM32,000 and RM35,000? [5 marks]

iii) The sales manager wants to award the sales representatives who earn the largest commission a bonus of RM1,000. He can award a bonus to 20% of the top sales representatives. How much should the sales representative earn to be entitled to the bonus? [4 marks]

QUESTION 3 [20 marks]

The manufacturer of an MP3 player wanted to know whether a 10% reduction in price is enough to increase the sales of its product. To investigate, the owner randomly selected 8 outlets and sold the MP3 player at the reduced price. At 7 randomly selected outlets, the MP3 player was sold at the normal price. The number of units sold last month at the normal and reduced prices are reported below. At 0.01 significance level, can the manufacturer conclude that the price reduction resulted in an increase in sales?

Normal price	138	121	88	115	141	125	96	
Reduced price	128	134	152	135	114	106	112	120

[20 marks]

QUESTION 4 [20 marks]

City planners believe that the age of the residents depends on the size of the population. To investigate the relationship, data on the population and median age in 10 large cities were collected.

City	Population (in millions)	Median Age
Chicago	2.833	31.5
Dallas	1.233	29.8
Houston	2.144	30.9
Los Angeles	3.849	31.6
New York	8.214	34.2

City	Population (in millions)	Median Age
Philadelphia	1.654	34.2
Phoenix	1.352	30.7
San Antonio	1.296	31.7
San Diego	1.255	32.7
San Jose	0.936	32.6

Continued...

(a) Identify the independent variable and the dependent variable [1 mark]
(b) Compute the coefficient of correlation and interpret its value. [3 marks]
(c) Compute the coefficient of determination and interpret its value. [3 marks]
(d) Determine the Least Square regression equation. [5 marks]
(e) Interpret the meaning of the slope. [2 marks]
(f) Estimate the median age for a city with 900,000 population size. Is the estimation reliable? Explain. [6 marks]

QUESTION 5 [20 marks]

(a) Amelia has just purchased a $160,000 house and has made a down payment of $25,000. She can amortize the balance at 10.5% for 30 years.

i) What is the quarterly payment? [5 marks]
ii) What is the total interest paid? [3 marks]

(b) How long should it take for an investment of RM5000 to grow to RM15,000 when interest is compounded semi-annually at 6.5%? [3 marks]

(c) The prices and quantities sold at the clothing emporium for ties, suits and shoes for March 2015 and March 2018 are reported below:

Item	2015		2018	
	Price (RM)	Quantity	Price (RM)	Quantity
Ties (each)	13.00	1000	18.00	900
Suits (each)	120.00	100	200.00	140
Shoes (pair)	35.00	500	59.00	500

i) Compute and interpret the price index of suits for 2018 using 2015 as the base period. [3 marks]
ii) Compute and interpret the value index for 2018 using 2015 as the base period. [6 marks]

End of Page

STATISTICAL FORMULAE

A. DESCRIPTIVE STATISTICS

Mean ($\bar{x}$) = $\dfrac{\sum_{i=1}^{n} X_i}{n}$

Standard Deviation (s) = $\sqrt{\dfrac{\sum_{i=1}^{n} X_i^2}{n-1} - \dfrac{(\sum_{i=1}^{n} X_i)^2}{n(n-1)}}$

Coefficient of Variation (CV) = $\dfrac{\sigma}{\overline{X}} \times 100$

Pearson's Coefficient of Skewness (S_k) = $\dfrac{3(\overline{X} - Median)}{s}$

B. PROBABILITY

P (A or B) = P (A) + P (B) – P (A and B)

P (A and B) = P (A)× P (B) if A and B are independent

P (A | B) = P (A and B) ÷ P (B)

Poisson Probability Distribution

If X follows a Poisson Distribution , $P(\lambda)$ where $P(X = x) = \dfrac{e^{-\lambda}\lambda^x}{x!}$

then the mean = $E(X) = \lambda$ and variance = $VAR(X) = \lambda$

Binomial Probability Distribution

If X follows a Binomial Distribution B(n, p) where $P(X = x) = {}^nC_x p^x q^{n-x}$

then the mean = $E(X) = np$ and variance = $VAR(X) = npq$ where $q = 1 - p$

Normal Distribution

If X follows a Normal distribution, $N(\mu, \sigma)$ where $E(X) = \mu$ and $VAR(X) = \sigma^2$

then $Z = \dfrac{X - \mu}{\sigma}$

C. CONFIDENCE INTERVAL ESTIMATION AND SAMPLE SIZE DETERMINATION

$(100-\alpha)$ % Confidence Interval for Population Mean (σ Known) = $\mu = \overline{X} \pm Z_{\alpha/2}\left(\sigma/\sqrt{n}\right)$ $(100-\alpha)$% Confidence Interval for Population Mean (σ Unknown) = $\mu = \overline{X} \pm t_{\alpha/2,n-1}\left(s/\sqrt{n}\right)$
$(100-\alpha)$% Confidence Interval for Population Proportion = $\pi = p \pm Z_{\alpha/2}\sqrt{\frac{p(1-p)}{n}}$
Sample Size Determination for Population Mean : $n \geq \left[\frac{(Z_{\alpha/2})\sigma}{E}\right]^2$ Sample Size Determination for Population Proportion : $n \geq \frac{Z^2 \times p(1-p)}{E^2}$ Where E = Limit of Error in Estimation

D. HYPOTHESIS TESTING

One Sample Mean Test	
Standard Deviation (σ) Known	**Standard Deviation (σ) Not Known**
$Z = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}}$	$t = \frac{\bar{x}-\mu}{s/\sqrt{n}}$
One Sample Proportion Test	
$Z = \frac{p-\pi}{\sqrt{\frac{\pi(1-\pi)}{n}}}$	

Two Sample Mean Test	
Standard Deviation (σ) Known	**Standard Deviation (σ) Not Known**
$z = \frac{(\overline{x}_1-\overline{x}_2)-(\mu_1-\mu_2)}{\sqrt{\sigma_1^2/n_1+\sigma_2^2/n_2}}$	$t = \frac{(\overline{x}_1-\overline{x}_2)-(\mu_1-\mu_2)}{\sqrt{S_p^2\left(1/n_1+1/n_2\right)}}$ where $S_p^2 = \frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{(n_1+n_2-2)}$

Two Sample Proportion Test
$Z = \frac{(p_1-p_2)-(\pi_1-\pi_2)}{\sqrt{\bar{p}(1-\bar{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$ where $\bar{p} = \frac{X_1+X_2}{n_1+n_2}$; $p_1 = \frac{X_1}{n_1}$; $p_2 = \frac{X_2}{n_2}$ *where X_1 and X_2 are the number of successes from each population*

E. REGRESSION ANALYSIS

Simple Linear Regression

$Y_i = \beta_0 + \beta_1 X_1 + \varepsilon_i$ Where $\beta_0 = \overline{Y} - \beta_1 \overline{X}$ and $\beta_1 = \dfrac{\sum XY - \left[\dfrac{\sum X \sum Y}{n}\right]}{\left[\sum X^2 - \left(\dfrac{(\sum X)^2}{n}\right)\right]}$

Correlation Coefficient

$$r = \frac{\sum XY - \left[\dfrac{\sum X \sum Y}{n}\right]}{\sqrt{\left[\sum X^2 - \left(\dfrac{(\sum X)^2}{n}\right)\right]\left[\sum Y^2 - \left(\dfrac{(\sum Y)^2}{n}\right)\right]}} = \frac{COV(X,Y)}{\sigma_X \sigma_Y}$$

ANOVA Table for Regression

Source	Degrees of Freedom	Sum of Squares	Mean Squares
Regression	1	SSR	MSR = SSR/1
Error/Residual	$n-2$	SSE	MSE = SSE/$(n-2)$
Total	$n-1$	SST	

Test Statistic for Significance of the Predictor Variable

$t_i = \dfrac{b_i}{S_{b_i}}$ and the critical value $= \pm t_{\alpha/2,(n-p-1)}$

Where p = number of predictor

F. INDEX NUMBERS

Simple Price Index

$$P = \frac{p_t}{p_0} \times 100$$

Laspeyres Quantity Index

$$P = \frac{\sum p_0 q_t}{\sum p_0 q_0} \times 100$$

Aggregate Price Index

$$P = \frac{\sum p_t}{\sum p_0}(100)$$

Paasche Quantity Index

$$P = \frac{\sum p_t q_t}{\sum p_t q_0} \times 100$$

Laspeyres Price Index

$$P = \frac{\sum p_t q_0}{\sum p_0 q_0} \times 100$$

Fisher's Ideal Price Index

$$\sqrt{(Laspeyres\ Price\ Index)(Paasche\ Price\ Index)}$$

Paasche Price Index

$$P = \frac{\sum p_t q_t}{\sum p_0 q_t} \times 100$$

Value Index

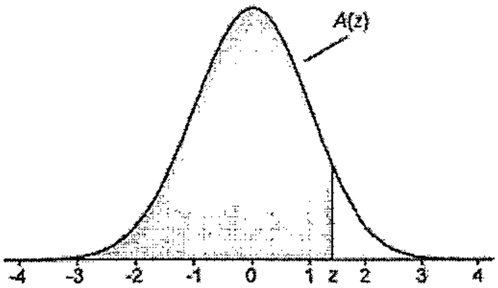
$$V = \frac{\sum p_t q_t}{\sum p_0 q_0} \times 100$$

G. FINANCIAL MATHEMATICS

Simple Interest $I = Pnr$ $A = P(1 + nr)$	**Compounded Interest** $I_t = P[(1+i)^n - 1]$ $A_t = P(1+i)^n$
Effective Rate of Interest $r_{\text{effective}} = \left(1 + \frac{r}{m}\right)^m - 1$	**Sinking Fund** $S = R\left[\frac{(1+i)^n - 1}{i}\right]$
Future Value $A_t = P(1+i)^n$	**Present Value** $P = A(1+i)^{-n}$
Future Value of an Annuity $FV_A = R\left[\frac{(1+i)^n - 1}{i}\right]$	**Present Value of an Annuity** $PV_A = R\left[\frac{1-(1+i)^{-n}}{i}\right]$
Amortization $R = \left[\frac{P(i)}{1-(1+i)^{-n}}\right]$	

TABLE A.1

Cumulative Standardized Normal Distribution

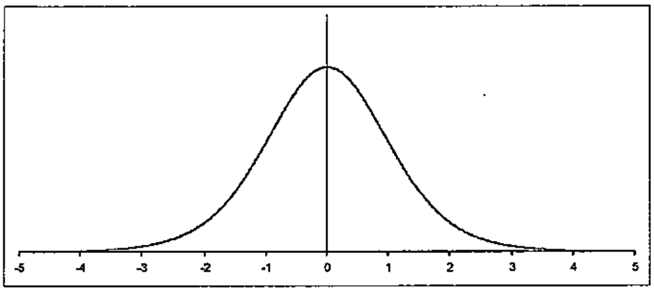


$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:

z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							

Table 2: The t-distribution ($t_{\alpha, n-1}$)



$\alpha =$	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
(n-1) = 1	3.078	6.314	12.706	31.821	63.657	318.309	636.619
2	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3,646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291